

05/28/99

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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. P-2590-1 /TAC
 First Inventor or Application Identifier Josh Kelman
 Title Improved Method.....BSR Elastomer
 Express Mail Label No. BL370016195US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

- ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
- ☒ Specification [Total Pages 18]
(preferred arrangement set forth below)
 - Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
- ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 5]
- ☒ Oath or Declaration [Total Pages 5]
 - ☒ Newly executed (original or copy)
 - ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

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- ☐ Microfiche Computer Program (Appendix)
- Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
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ACCOMPANYING APPLICATION PAPER(S)

- ☐ Assignment Papers (cover sheet & document(s))
- ☐ 37 C.F.R. § 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
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17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Labelor ☒ Correspondence address below

(Insert Customer No. or Attach bar code label here)

Name	Eric T. Jones			
	Reising, Ethington, Barnes, Kisselle,			
	Learman & McCulloch, P.C.			
Address	P.O. Box 4390			
City	Troy	State	Michigan	Zip Code 48099-4390
Country	U.S.A.	Telephone	248-689-3500	Fax 248-689-4071

Name (Print/Type)	Eric T. Jones	Registration No. (Attorney/Agent)	40,037
Signature	<i>Eric T. Jones</i>	Date	5-28-99

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IMPROVED METHOD FOR APPLYING BSR ELASTOMER

TECHNICAL FIELD OF THE INVENTION

5 This invention relates generally to automotive trim parts and, more particularly, to a sound deadening method for reducing noises such as buzzes, squeaks and rattles that are generated by adjacent trim parts rubbing together.

INVENTION BACKGROUND

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Motor vehicles commonly include interior trim components such as switch plate bezels, demisters, light housings, speaker covers, decorative appliques, storage compartments and the like that are attached within portions of interior trim panel surfaces of such vehicles. Examples of trim panels that such components are commonly installed in include instrument panels, door panels, headliners, package trays, seats and center consoles. The trim panels are often made of laminated material and include an outer layer that displays a decorative appearance. Adjacent trim panels are usually designed to fit together closely or to partially overlap with only a narrow seam separating them.

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This close fit between trim panels and components mounted in the panels or between adjacent trim panels often results in noises, such as buzzes, squeaks and rattles, that result from contact and relative motion between surfaces of edges of adjacent trim parts. This noise is sometimes referred to as BSR (buzz, squeak, rattle) or NVH (noise, vibration, harshness). To mitigate the BSR/NVH problem, some production automobile assemblies apply a buffer material in the form of flat adhesive-backed tape (BSR tape) to one or both mating surfaces (typically panel edges) between adjacent trim parts. However, the tape application process is labor-intensive and can result in exposed tape that vehicle occupants can see, thus detracting from the finished appearance of a vehicle interior.

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To reduce labor requirements and improve quality, some systems apply buffer material in the form of extruded elastomers rather than tape. The buffer material is extruded onto the mating surface and/or surfaces by an applicator in the form of an extruder head and allowed to cure before assembly. In some such systems extruder head movement is robotically controlled. One problem with adapting these systems to use in applying buffer material to automotive trim is that it is difficult to adhere elastomers to all the materials used to form automotive trim components and panels. Trim assemblies sometimes include mating trim parts that are made of several different materials, e.g., PVC, PP, PC/ABS, ABS, paint, wood, textiles, etc. It would be difficult to provide a robotic applicator system that could cost-effectively apply different buffer materials to all these different trim materials. To do so would likely require either multiple robotic applicators, each applying a different buffer material, or a single applicator capable of rapidly and repeatedly changing the type of buffer material it applies.

It is known to augment the holding power of hot melt adhesives by applying such adhesives to an undercut groove in such a way as to form a mechanical as well as an adhesive bond. For example, United States Patent number 3,635,117 issued to Nagao on January 18, 1972 discloses a method for fixing a woodwind instrument. The method includes the step of forming an undercut groove in a first part of the instrument to be joined to a second part of the instrument. Hot melt adhesive is then introduced into the undercut groove and onto adjacent surfaces of the first part of the instrument. The second part of the instrument is then joined to the first part of the instrument with the hot melt adhesive sandwiched between. When the adhesive cools and cures it provides both an adhesive bond between the parts and a mechanical lock where it has dried within the undercut region of the groove. The Nagao patent does not disclose how the first part is grooved and undercut or how the adhesive is applied.

What is needed is a sound deadening method for interior vehicle trim parts that can provide a bead of a single buffer material between adjacent parts by applying the bead to one or both vehicle interior trim parts even where the parts

have differing material compositions. What is also needed is apparatus configured to apply the buffer material.

INVENTION SUMMARY

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A method is provided for assembling interior vehicle trim parts in which a first trim part is mounted adjacent a second trim part and in which a bead of buffer material is mechanically locked into a recess in one of the first and second trim parts. The bead is included to reduce noises such as buzzes, squeaks and rattles produced by contact and relative motion between the first and second trim parts. According to the method, the first trim part is provided having a mating surface configured to lie alongside a mating surface of the second trim part when the first and second trim parts are mounted adjacent one another in a vehicle. The recess is then formed in the mating surface of the first trim part and the buffer material is provided in the recess. The buffer material is provided in such a way as to provide a bead of buffer material on the mating surface of the first trim part. The bead is allowed to mechanically connect to the first trim part because of the hardening of the buffer material within the recess.

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According to another aspect of the inventive method, the recess is formed to include an undercut to more positively lock the hardened buffer material onto the mating surface of the first trim part.

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According to another aspect of the inventive method, the buffer material preferably comprises an elastomeric material. A suitable elastomeric buffer material is preferably selected from a group consisting of thermoplastic elastomers (TPEs) and thermosetting elastomers. Thermoplastic urethane (TPU) is a preferred form of TPE to be used as the buffer material.

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According to another aspect of the inventive method, buffer material is provided in the recess by providing an applicator comprising an extrusion head and extruding buffer material through the extrusion head and into the recess.

According to another aspect of the inventive method, in forming the recess a robot is operatively connected to a recess-forming tool and the robot is operated in such a way as to move the forming tool into and along the mating surface of the first trim part.

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According to another aspect of the inventive method, in providing buffer material a robot is provided that is operatively connected to an applicator. A source of buffer material is connected to the applicator such that the buffer material is in fluid communication with the applicator. The robot is then operated
10 in such a way as to move the applicator in spaced generally parallel relationship with the mating surface of the first trim part while projecting buffer material into the recess and onto the mating surface.

According to another aspect of the inventive method, in providing the
15 buffer material an applicator is operatively connected to the robot adjacent the recess-forming tool. A source of buffer material is then connected to the applicator in such a way as to be in fluid communication with the applicator. The robot is then operated in such a way as to simultaneously move the forming tool into and along the mating surface of the first trim part while moving the
20 applicator in spaced generally parallel relationship with the mating surface and in trailing relationship to the recess-forming tool. The trailing applicator provides buffer material in the recess formed by the preceding forming tool, overfilling the recess and providing a bead of buffer material on the mating surface of the first trim part.

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According to another aspect of the inventive method, the forming tool provided includes a router having a router bit configured to form a recess of desired cross sectional shape.

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According to another aspect of the inventive method, the second trim part is configured to be mounted in an opening in the first trim part, the mating surface of the second trim part being an outer peripheral edge of the second trim

part. Likewise, the mating surface of the first trim part is an inner edge of the first trim part that surrounds and defines the opening in the first trim part.

Also according to the invention, a bead forming apparatus is provided for forming a bead of buffer material on a mating surface of an automotive trim part according to the above method. The bead forming apparatus comprises a recess-forming tool and an applicator on a common mount. The recess-forming tool is configured to form a recess in the mating surface. The applicator is configured to provide buffer material in the recess and to form a bead on the mating surface by overfilling the recess. A drive is operatively connected to the common mount and is configured to move the recess-forming tool and the applicator simultaneously with respect to the mating surface with the applicator trailing the recess-forming tool. A source of buffer material is in fluid communication with the applicator and is configured to supply the buffer material to the applicator. By mounting both the recess-forming tool and the applicator on the same mount and driving them together, the recess may be formed and the buffer material applied in the same manufacturing step.

According to another aspect of the invention, the recess-forming tool is configured to form a recess that includes an undercut. The undercut provides a secure mechanical lock between the bead and the mating surface.

According to another aspect of the invention, the forming tool comprises a router. The router efficiently forms the recess and the undercut in one operation.

According to another aspect of the invention, the applicator comprises an extruder head configured to extrude buffer material into the recess and onto the mating surface.

According to another aspect of the invention, the drive includes a robot having a multi-axis drive system. The robot and drive system provide accurate, consistent application resulting in the formation of a uniform bead.

According to another aspect of the invention, the recess-forming tool and applicator are mounted on an arm of the robot. The arm allows the robot to move the recess-forming tool and applicator along mating surfaces of a variety of shapes and sizes.

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According to another aspect of the invention, the applicator is movably mounted relative to the recess-forming tool. In addition, the robot multi-axis drive system is configured move the applicator independent of the recess-forming tool while simultaneously moving the recess-forming tool and the applicator along the mating surface. This allows the applicator to be positioned, to a certain extent, independently from the recess-forming tool. This results in greater control over bead size and placement.

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BRIEF DRAWING DESCRIPTION

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To better understand and appreciate the invention, refer to the following detailed description in connection with the accompanying drawings:

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Figure 1 is a schematic perspective view of a bead forming apparatus constructed according to the invention and shown forming a bead on a mating edge of a trim part;

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Figure 1A is a schematic magnified view of the portion of Figure 1 enclosed by circle A;

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Figure 2 is a partial cross-sectional end view of the trim part of Figure 1;

Figure 3 is a partial perspective view of a second trim part mounted adjacent the trim part of Figure 1 with the bead of Figure 1 sandwiched between;

Figure 3A is a magnified view of one end of a junction between the second trim part and the trim part of Figure 1;

Figure 4 is a partial cross-sectional end view of the trim part of Figure 1;

Figure 5 is a partial perspective schematic view of the bead forming apparatus of Figure 1 and shown forming a bead along an inner edge defining an opening in a trim part with a cut-away portion of a second trim part shown in phantom mounted within the opening;

Figure 6 is a partial perspective view of a lap joint of two trim parts with a bead disposed between mating edges of the two trim parts; and

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Figure 7 is a partial perspective view of a lap joint of two trim parts with a bead disposed between an elongated lap flange of one trim part and a side surface of the other trim part.

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PREFERRED EMBODIMENT DESCRIPTION

A bead forming apparatus constructed according to the invention is generally shown at 10 in Figures 1, 1A and 5. The bead forming apparatus 10 is operable to form a bead 12 of buffer material on the mating surface 14 of a first automotive trim part 16. As shown in Figures 1-3A, the first trim part 16 may be a trim panel of generally uniform thickness with the mating surface 14 comprising at least one peripheral outer edge 18. Alternatively, as shown in Figure 5, the first trim part may be a trim panel 16' of generally uniform thickness with its mating surface 14' comprising at least one inner edge 18' defining an opening 20 in the trim panel 16'.

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The bead forming apparatus 10 comprises a recess-forming tool generally indicated at 22 in Figures 1, 1A and 5. The recess-forming tool 22 is configured to form a recess 24, in the mating surface 14 of the first trim part 16 as is most clearly shown in the magnified view of Figure 1A. The forming tool 22 comprises a router generally indicated at 26 in Figures 1, 1A and 4. The router 26 has a router bit 28 configured to form the recess 24 to include a desired cross-

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sectional shape, i.e.; a recess 24 having undercuts 30. As best shown in Figures 2 and 3A the forming tool 22 cuts the recess 24 in the form of a keylock type groove having a T-shaped cross section of uniform size and shape along its length. The recess-forming tool 22 may alternatively employ other suitable types of cutting tools known in the art resulting in grooves having different shapes. For example, as shown in Figure 4, the bead forming apparatus may be configured to cut a recess 24a having a dove-tail cross-sectional shape along its length. (Structures shown in Figure 4 that correspond to similar or identical structures in Figure 3A are referenced by the same reference numerals but with the suffix "a".)

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As shown in Figures 6 and 7, the recess forming tool 22 can also be configured to form a recess 24b, 24c in a mating surface 14b, 14c of a trim part 16b, 16c that includes a lap joint flange 60, 60c. (Structures shown in Figures 6 and 7 that correspond to similar or identical structures shown in Figures 3 or 3A are referenced by the same reference numerals only with the suffixes "b" and "c", respectively). As shown in Figure 6, a recess 24b may, similar to recess 24 of Figures 3 and 3A, still be formed in a mating surface 14b disposed on a peripheral edge of trim part 16b. However, as shown in Figure 7, a recess 24c may alternatively be formed in a mating surface 62 of the lap joint flange 60c.

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The bead forming apparatus 10 also includes an applicator generally indicated at 32 in Figures 1, 1A and 5. The applicator 32 is configured to provide buffer material in the recess 24 and to form a raised portion or bead 12 on the mating surface 14 by overfilling the recess 24. A source of buffer material is shown at 34 in Figure 1. The source 34 of buffer material is in fluid communication with the applicator 32 and is configured to supply the buffer material to the applicator 32 through a hose shown at 36 in Figures 1, 1A and 5. The source 34 of buffer material is also configured to force the buffer material through the applicator 32 and onto the mating surface 14 of the first trim part 16. The applicator 32 comprises an extruder head shown at 38 in Figures 1, 1A and 5. The extruder head 38 is configured to extrude the buffer material into the recess 24 and onto the mating surface 14 of the first trim part 16. The bead forming

apparatus 10 may alternatively include other suitable apparatus capable of providing buffer material in the recess 24 and forming the bead 12 on the mating surface 14.

5 The buffer material may comprise any one or more of a number of different materials including thermoplastic elastomers (TPEs) and thermosetting elastomers. Thermoplastic urethane (TPU) is a preferred form of TPE to be used as the buffer material. The buffer material may alternatively include other suitable materials not considered to be elastomers, but that are still capable of
10 reducing BSR between adjacent trim parts.

 A common mount shown at 40 in Figures 1, 1A and 5 supports both the recess-forming tool 22 and the applicator 32. The mount 40 includes a knuckle 42 disposed between the applicator 32 and the recess-forming tool 22. The
15 knuckle 42 allows the applicator 32 to be moved, to a certain degree, independently of the recess-forming tool 22. The applicator 32 is, therefore, movably mounted relative to the recess-forming tool 22 and can be independently adjusted to extrude the buffer material in a variety of directions relative to the path of the applicator 32 over the mating surface 14 of the first trim part 16. In
20 other embodiments a structure other than a knuckle may be used to provide relative motion between the applicator 32 and the recess-forming tool 22.

 A drive is operatively connected to the mount 40 and is configured to move the recess-forming tool 22 and the applicator 32 simultaneously with
25 respect to the mating surface 14 with the applicator 32 trailing the recess-forming tool 22. The drive, generally indicated at 44 in Figures 1, 1A and 5, includes a robot 46 having a multi-axis drive system 48. The recess-forming tool 22 and applicator 32 are mounted on an articulated arm 50 of the multi-axis drive system 48. In addition, the robot multi-axis drive system 48 is configured to move the
30 applicator 32 independent of the recess-forming tool 22 while simultaneously moving the recess-forming tool 22 and the applicator 32 along the mating surface 14. This allows the drive system 48 to automatically change applicator aim "on

the fly", i.e., as the recess-forming tool 22 is forming the recess 24 and the applicator 32 is extruding and applying the buffer material. The ability to change applicator aim "on the fly" allows bead configuration and position to be altered in response to changes in factors such as mating surface width and desired bead thickness at various points along a given mating surface 14.

A method is provided for assembling interior vehicle trim parts such as the trim panels 16, 52 in Figures 3, 3A and 5 in which a first one 16 of the trim panels is mounted adjacent a second one 52 of the trim panels and a bead 12 of buffer material is provided between the first and second trim panels 16, 52. The bead 12 is included between the trim panels 16, 52 to reduce noises such as buzzes, squeaks and rattles produced by contact and relative motion such as vibration and sliding between the first and second trim parts 16, 52. The bead 12 may be applied by any suitable means such as the bead forming apparatus 10 described above and schematically shown in the drawings.

According to the method, the first trim panel 16 is formed by injection molding or by any other suitable method known in the art for producing such parts. Formation of the first trim panel 16 includes formation of the mating surface 14 on the first trim panel 16, i.e., the surface that is configured to lie alongside and complement a mating surface 54 of the second trim panel 52 when the first and second trim panels 16, 52 are mounted adjacent one another in a vehicle. The mating surfaces 14, 54 are shaped to complement one another in an edgewise, abutting relationship as shown, for example, in Figures 3 and 3A. The first and second trim panels 16, 52 are shaped so that, when mounted adjacent one another, their respective mating surfaces 14, 54 are separated by a generally uniform gap shown at 56 in Figures 3, 3A and 5. The gap 56 is of sufficient width to accommodate at least a thin bead 12 of buffer material.

The recess 24 is then formed in the mating surface 14 of the first trim panel 16. The recess 24 is formed to include two undercut portions 30 of the T-shaped cross-sectioned keylock-type groove described above and shown in

Figures 2, 3, and 3A. A recess-forming tool 22 such as that described above may be used to form the recess 24.

To form the recess 24 a robot, such as the robot 46 described above and schematically shown in Figures 1, 1A and 5, may be operatively connected to the recess-forming tool 22. As described above, the tool 22 may be mounted at one end of the articulated arm 50 of the robot 46. The robot 46 is then operated in such a way as to move the forming tool 22 into and along the mating surface 14 of the first trim panel 16.

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A material such as the above-described elastomeric buffer material is then provided in the recess 24. This may be done by providing an applicator such as the above-described applicator 32, and extruding buffer material into the recess 24 through an extruder head 38 of the applicator 32. The buffer material is extruded into the recess 24 in such a way as to overfill the recess 24 and provide a bead 12 of buffer material on the mating surface 14 of the first trim panel 16. As the buffer material fills the recess 24 it flows into and fills the undercut regions 30 and hardens. By hardening in the undercut regions 30 the buffer material provides a positive mechanical lock between the bead 12 and the mating surface 14 of the first trim panel 16. In other words, the bead 12 mechanically connects to the first trim panel 16 because of the hardening of the buffer material within the recess 24. As used herein, "hardening" refers to an increase in viscosity, or, conversely, a decrease in flow characteristics.

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A robot, such as the above-described robot 46, may be operatively connected to the applicator 32. The applicator 32 may be mounted at one end of an articulated arm 50 of the robot 46 adjacent the recess-forming tool 22 and in a trailing position as shown and described above. The source 34 of buffer material is connected to the applicator 32 such that the buffer material is placed in fluid communication with the applicator 32. The robot 46 is then operated in such a way as to simultaneously move the forming tool 22 into and along the mating surface 14 of the first trim panel 16 while moving the applicator 32 in spaced

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generally parallel relationship with the mating surface 14 and in trailing relationship to the recess-forming tool 22. The trailing applicator 32 provides buffer material in the recess 24 formed by the preceding forming tool 22, overfilling the recess 24 and providing a bead 12 of buffer material on the mating surface 14 of the first trim panel 16. In other embodiments, the applicator 32 and forming tool 22 may be mounted separately, e.g., on separate robot arms. After forming the bead 12, the forming tool 22 and applicator 32 are removed from the first trim panel 16, e.g., by operating the robot 46 in such a way as to move the forming tool 22 and applicator 32 to a position remote from the trim panel 16.

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Finally, the second trim panel 52 is installed adjacent the first trim panel 16 such that the bead 12 is sandwiched and compressed between the respective mating surfaces 14, 54 of the trim panels 16, 52. The bead 12 may be formed in such a way as to completely or only partially fill the gap 56 between the mating surfaces 14, 54 of the mounted trim panels 16, 52. In any case, the bead 12 provides a noise-limiting material barrier and may serve as a cushion between the respective mating surfaces 14, 54 of the trim panel 16, 52.

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In other embodiments, the "butt joint" depicted may be replaced with a "lap joint", tongue and groove, etc., or any other suitable joint configuration. As shown in Figure 5, the first trim part 16' may comprise an opening 20 into which the second trim part 52' may be mounted. In this embodiment, trim part 16' is a trim panel while trim part 52' may be a trim component. A mating surface 54' of trim component 52' is disposed on an outer peripheral edge 56' of trim component 52'. Likewise, the mating surface 14' of trim panel 16' is disposed on an inner edge of trim panel 16' that surrounds and defines the opening 20 in trim panel 16'. This configuration is common in automotive trim panels that house trim components such as radios, CD players, HVAC controls, and the like.

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In applying buffer material to trim parts configured as shown in Figure 5, a recess 24' and bead 12' may be formed by operating a robot 46 to insert the forming tool 22 and applicator 32 into the opening 20 and moving them along

and around the inner edge 18' of the first trim part 16'. Following bead application, the robot 46 is operated in such a way as to remove the forming tool 22 and applicator 32 from the opening 20. Alternatively, the buffer material may be attached to the outer edge 56' of the second trim part 52' by operating the robot 46 to move the forming tool 22 and applicator 32 along and around the outer edge 56' of the second trim part 52'. In either case, the first and second trim parts 16', 52' are then joined together sandwiching the bead 12' between the inner edge 18' of the first trim part 16' and the outer edge 56' of the second trim part 52'. As with the first embodiment, other types of joints may be used.

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The inventive method and bead forming apparatus 10 eliminate several critical problems often encountered when using extruded elastomeric material as a BSR tape replacement. In addition to eliminating adhesion concerns, a system developed according to the invention will allow for the use of significantly lower cost elastomers since they do not have to be blended for adhesion properties.

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We intend the above description to illustrate embodiments of the present invention by using descriptive rather than limiting words. Obviously, there are many ways that one might modify these embodiments while remaining within the scope of the claims. In other words, there are many other ways that one may practice the present invention without exceeding the scope of the claims.

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We claim:

1. A method for assembling interior vehicle trim parts in which a first trim part is disposed adjacent a second trim part and in which a bead of buffer material is provided between the first and second trim parts to reduce noises such as buzzes, squeaks and rattles produced by contact and relative motion between the first and second trim parts, the method including the steps of:
 - providing the first trim part having a mating surface configured to lie alongside a mating surface of the second trim part when the first and second trim parts are disposed adjacent one another in a vehicle;
 - forming a recess in the mating surface of the first trim part; and
 - providing buffer material in the recess so as to provide a bead of buffer material on the mating surface of the first trim part; and
 - allowing the bead to mechanically connect to the first trim part by hardening of the buffer material within the recess.
2. The method of claim 1 in which the step of forming a recess includes forming the recess to include an undercut.
3. The method of claim 1 in which the step of providing buffer material in the recess includes the steps of:
 - providing an applicator comprising an extrusion head; and
 - extruding buffer material through the extrusion head.
4. The method of claim 1 in which the step of providing buffer material includes providing an elastomeric material.
5. The method of claim 1 in which the step of providing buffer material includes selecting the buffer material from a group consisting of thermoplastic elastomers and thermosetting elastomers.

6. The method of claim 5 in which the step of providing buffer material includes selecting thermoplastic urethane as a buffer material.

7. The method of claim 1 in which the step of providing buffer material includes the steps of:

- providing a robot operatively connected to an applicator;
- connecting a source of buffer material to the applicator, the buffer material being in fluid communication with the applicator; and
- operating the robot to move the applicator in spaced generally parallel relationship with the mating surface of the first trim part while projecting buffer material into the recess and onto the mating surface.

8. The method of claim 1 in which the step of forming a recess includes the steps of:

- providing a robot operatively connected to a recess-forming tool; and
- operating the robot to move the forming tool into and along the mating surface of the first trim part.

9. The method of claim 8 in which the step of providing buffer material includes the steps of:

- operatively connecting an applicator to the robot adjacent the recess-forming tool;
- connecting a source of buffer material in fluid communication with the applicator; and
- operating the robot to simultaneously move the forming tool into and along the mating surface of the first trim part while moving the applicator in spaced generally parallel relationship with the mating surface and in trailing relationship to the recess-forming tool, the trailing applicator providing buffer material in the recess formed by the preceding forming tool so as to and overfill the recess and provide a bead of buffer material on the mating surface of the first trim part.

10. The method of claim 1 in which the step of forming a recess includes providing a forming tool comprising a router having a router bit configured to form a recess of desired cross sectional shape.

5 11. The method of claim 1 including the additional step of mounting the second trim part in an opening in the first trim part, the mating surfaces being an outer peripheral edge of the second trim part and an inner edge of the first trim part surrounding and defining the opening in the first trim part, the additional step following the step of allowing the buffer material to
10 mechanically connect to the first trim part.

12. Bead forming apparatus for forming a bead of buffer material on a mating surface of an automotive trim part, the apparatus comprising:
a recess-forming tool configured to form a recess in the mating surface;
15 an applicator configured to provide buffer material in the recess and to form a bead on the mating surface by overfilling the recess;
a common mount supporting both the recess-forming tool and the applicator; and
a drive operatively connected to the mount and configured to move the
20 recess-forming tool and the applicator simultaneously with respect to the mating surface, the applicator trailing the recess-forming tool.

13. The bead forming apparatus of claim 12 in which the recess-forming tool is configured to form a recess that includes an undercut.
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14. The bead forming apparatus of claim 13 in which the forming tool comprises a router.

15. The bead forming apparatus of claim 12 in which the
30 applicator comprises an extruder head configured to extrude buffer material into the recess and onto the mating surface

16. The bead forming apparatus of claim 12 in which the drive includes a robot having a multi-axis drive system.

17. The bead forming apparatus of claim 16 in which the recess-
5 forming tool and applicator are mounted on an arm of the robot.

18. The bead forming apparatus of claim 17 in which:
the applicator is movably mounted relative to the recess-forming tool; and
the robot multi-axis drive system is configured move the applicator
10 independent of the recess-forming tool while simultaneously moving the recess-
forming tool and the applicator along the mating surface.

IMPROVED METHOD FOR APPLYING BSR ELASTOMER**ABSTRACT OF THE DISCLOSURE**

5 A method for assembling interior vehicle trim parts including panels and components in which two trim parts are disposed adjacent one another and in which a bead of buffer material is disposed between mating surfaces of the two trim parts. The bead is included to reduce noises such as buzzes, squeaks and
10 rattles produced by contact and relative motion between the first and second trim parts at their mating surfaces. The bead is mechanically locked into a recess in one of the mating surfaces. The bead is mechanically locked to a mating surface by forming a recess in the mating surface then applying buffer material in the recess. The buffer material is applied in such a way as to form a bead of buffer
15 material on the mating surface. The bead is allowed to mechanically connect to the first trim part as a result of the hardening of the buffer material within the recess.

FIG. 1

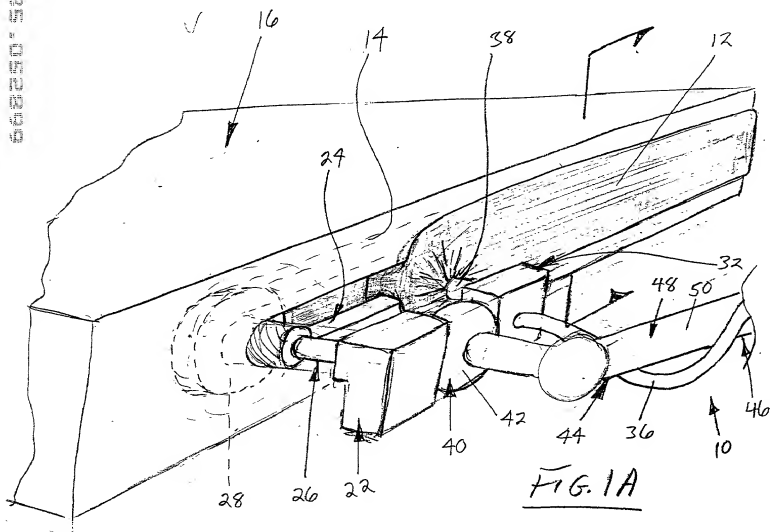
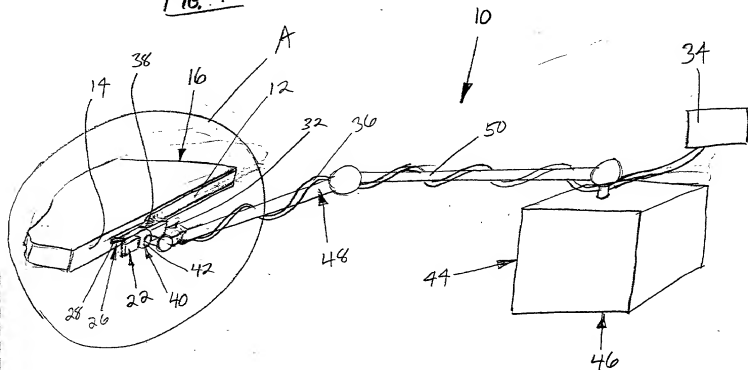


FIG. 1A

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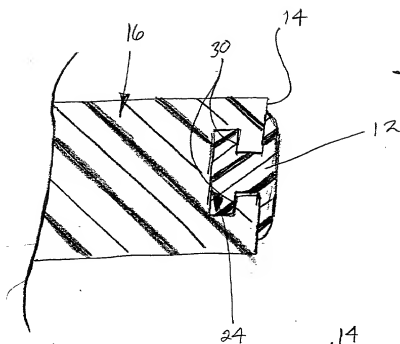


FIG 2.

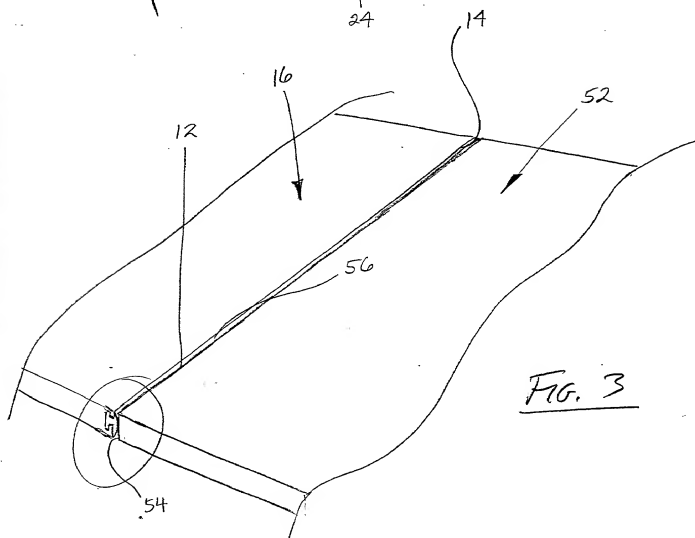


FIG. 3

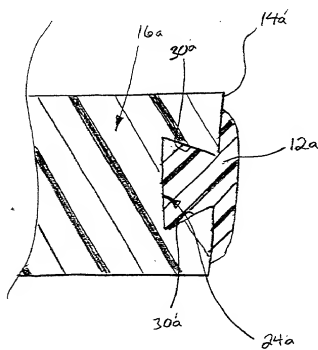
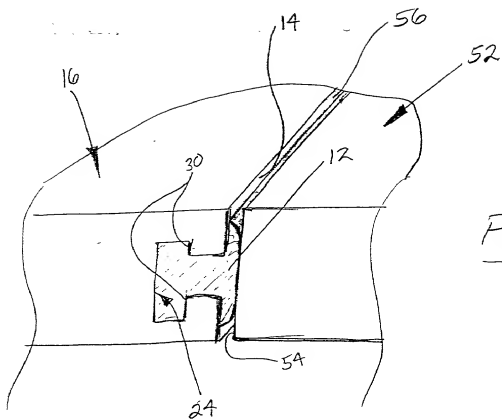
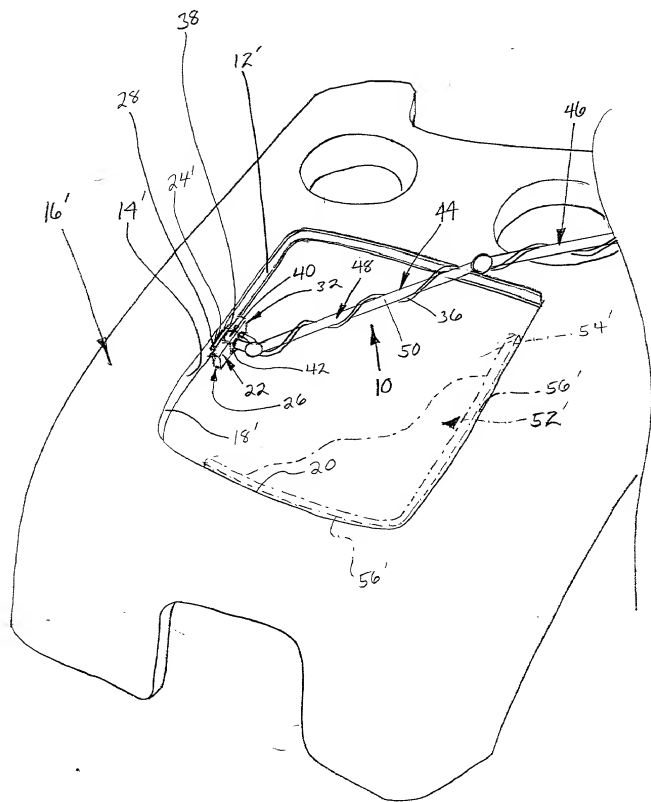


FIG. 5



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PATENT

Attorney's Docket No. P-2590-1/TAC

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL,
DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

☒ original
☐ design
☐ supplemental

NOTE: If the declaration is for an international Application being filed as a divisional, continuation or continuation-in-part application do not check next item; check appropriate one of last three items.

☐ national stage of PCT

NOTE: If one of the follow 3 items apply then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

☐ divisional
☐ continuation
☐ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

IMPROVED METHOD FOR APPLYING BSR ELASTOMER

SPECIFICATION IDENTIFICATION

the specification of which: (complete (a), (b) or (c))

(a) ☒ is attached hereto.
(b) ☐ was filed on _____ as _____
Serial No. 08/_____ or _____
Express Mail No. _____ (if Serial No. not yet known)
and was amended on _____ (if applicable)
(c) ☐ was described and claimed in PCT International Application No. _____
filed on _____ and as amended under PCT Article 19 on _____
(if any).

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 Code of Federal Regulations § 1.56 and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent.

In compliance with this duty there is attached an information disclosure statement.

PRIORITY CLAIM (35 U.S.C. § 119(a) - (d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) ☒ no such applications have been filed.

(e) ☐ such applications have been filed as follows

NOTE: Where item (c) is entered above and the International Application which designated the U.S. claimed priority check item (e), enter the details below and make the priority claim.

EARLIEST FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION AND ANY
PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIM UNDER 37 USC 119
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) (35 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

(Declaration and Power of Attorney [1-1] page 2 of 4)

ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

E.J. Biskup	18,987	E.T. Jones	40,037
R.C. Collins	27,430	J.F. Learman	17,069
P.J. Ethington	17,299	J.K. McCulloch	17,451
J.C. Evans	20,124	J.P. Moran	20,941
R.L. Farris	25,122	S.L. Permut	28,388
W.H. Francis	25,335	M.J. Schmidt	P43,904
F.J. Fodale	20,824	W.J. Schramm	24,795
W.H. Griffith	16,706	R.L. Stearns	36,937
A.M. Grove	39,697	J.D. Stevens	35,691
R.W. Hoffman	337114	W.J. Waugaman	20,304
		C.R. White	20,494

SEND CORRESPONDENCE TO

DIRECT TELEPHONE CALLS TO:
(NAME AND TELEPHONE NUMBER)


Eric T. Jones
Reising, Ethington, Barnes,
Kisselle, Learman & McCulloch, P.C.
P.O. Box 4390
Troy, Michigan 48099-4390


Eric T. Jones
(248) 689-3500

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE(S)

Full name of sole or first inventor Josh Kelman
Inventor's signature 
Date 5/14/99 Country of Citizenship U.S.A.
Residence Rochester, Michigan
Post Office Address 4223 Oak Tree Circle
Rochester, Michigan 48306

Full name of second joint inventor, if any Brian Pour
Inventor's signature 
Date 5/14/99 Country of Citizenship U.S.A.
Residence St. Clair Shores, Michigan
Post Office Address 22826 Englehardt St.
St. Clair Shores, Michigan 48080

CHECK PROPER BOX(ES) FOR ANY OF THE FOLLOWING ADDED
PAGE(S) WHICH FORM A PART OF THIS DECLARATION

- ☒ Signature for third and subsequent joint inventors. Number
pages added 1.
- ☐ Signature by administrator(trix), executor(trix) or legal
representative for deceased or incapacitated inventor. Number
of pages added _____
- ☐ Signature for inventor who refuses to sign or cannot be reached
by person authorized under 37 CFR 1.47. Number of pages
added _____

* * *

- ☐ Added pages to combined declaration and power of attorney for
divisional, continuation, or continuation-in-part (CIP)
application. _____ Number of pages added _____

* * *

- ☐ Authorization of attorney(s) to accept and follow instructions
from representative.

* * *

If no further pages form a part of this Declaration then end this
Declaration with this page and check the following item.

☐ **This declaration ends with this page.**

ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY
FOR SIGNATURE BY THIRD AND SUBSEQUENT INVENTORS

Full name of third joint inventor, if any Ed Shortridge

Inventor's signature Ed Shortridge

Date 5/14/99 Country of Citizenship U.S.A.

Residence Taylor, Michigan

Post Office Address 14119 Zigler

Taylor, Michigan 48180

Full name of fourth joint inventor, if any _____

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence _____

Post Office Address _____

Full name of fifth joint inventor, if any _____

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence _____

Post Office Address _____

Full name of sixth joint inventor, if any _____

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence _____

Post Office Address _____